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ULTRASONOGRAPHY, CT, MRI OF THE THYROID GLAND

Brian Gorman, M.B., B.Ch., F.R.C.R., M.B.A.
Carl C. Reading, M.D.
Mayo Medical School; Rochester, Minnesota.

INTRODUCTION

Ultrasonography, CT, and MRI may all be used to study the anatomy and pathology of the thyroid gland. Of these, however, ultrasonography is the main technique used in clinical practice for thyroid imaging, because it is noninvasive, relatively inexpensive, and very sensitive in detecting thyroid lesions. Therefore, this chapter focuses mainly on ultrasonographic imaging.

TECHNIQUES

Ultrasonography

The ultrasonographic examination of the thyroid is performed with the patient in the supine position, with the neck extended. A pad may be placed under the patient's shoulders to facilitate the examination. The examiner usually sits behind the patient. A high-frequency (7.5-13 MHz) linear array transducer is used to provide optimal near-field detail for the relatively superficial thyroid gland. Gray-scale imaging is performed primarily. Color and spectral Doppler may be used selectively to provide additional information. Scans of the neck are performed in the longitudinal and transverse planes. The ultrasonographic examination should include the lateral neck to look for lymph nodes along the jugular chains.

CT

CT is of limited value for studying the internal morphology of the thyroid. CT is used principally to image the extent of thyroid lesions and, in particular, any regional lymph node involvement. Contrast material is usually given at a rate of 2 to 3 mL/s to opacify blood vessels and to help distinguish them from enlarged nodes. If a helical scanner is used, scanning begins at 25 s, and 5-mm slices are obtained from the angle of the mandible to the superior mediastinum.

W. W. Herder (ed.), *Functional and Morphological Imaging of the Endocrine System*

MRI

MRI also has a limited role in thyroid imaging, because it has less spatial resolution and is relatively more expensive than ultrasonography. The technique does not usually provide a specific diagnosis for thyroid nodules. The major indications for MRI are to show the extent of substernal goiter and to evaluate the extent of invasive thyroid malignancy. A dedicated neck receiver coil is used to image the thyroid and to provide optimal spatial resolution and signal-to-noise ratio. Transaxial T_1- and fast spin-echo T_2-weighted images of the neck using thin slices (3 to 5 mm) are usually obtained. Images in the coronal or sagittal plane are useful to evaluate the retrosternal extension of goiter. Using a presaturation pulse (1) may reduce artifacts from flowing blood and motion.

ANATOMY

High-frequency ultrasound demonstrates the anatomy of the thyroid, adjacent musculature, and vessels in exquisite detail (Figure 1). The sternothyroid, sternohyoid, and omohyoid muscles are seen anterior to the thyroid. The sternocleidomastoid muscle is seen lateral to the thyroid. The longus colli muscle lies posterior to the thyroid lobes. The esophagus is usually seen to the left of the midline (Figure 2). Normal thyroid parenchyma has a homogeneous echotexture. Color Doppler is helpful in identifying blood vessels within and adjacent to the thyroid.

NODULAR DISEASE

Prevalence

In North America, the incidence of thyroid nodules detected by palpation is estimated to be 0.1% per year, with a prevalence of between 4% and 7% in the general population (2). Palpable thyroid nodules are more common in women, with advancing age, in areas of iodine deficiency, and after exposure to external radiation (3,4). In 1955, Mortensen et al. (5) examined thyroid glands removed at autopsy from 821 patients who had clinically normal thyroid glands. Clinically unsuspected thyroid nodules were found in 49.5% of these patients. Most of the nodules were benign. Only 4% of the nodular glands had malignant nodules. Most of the malignant nodules were small papillary tumors that typically follow an indolent course.